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INTEREST OF AMICI[1]

The American Lung Association ("ALA"), a nonprofit organization founded in 1904, is one of the nation's oldest voluntary health organizations. ALA's mission is to prevent lung disease and promote lung health. ALA is active in research, public education, and advocacy to reduce air pollution and its accompanying threats to lung health. ALA has published many reports on air pollution, most notably the annual *American Lung Association State of the Air* report. Through its advocacy programs, ALA has participated in the development and enforcement of laws and regulations related to lung health at the national, state, and local levels, including playing a major role in the passage of the Clean Air Act ("CAA") Amendments of 1977 and 1990.

The American Thoracic Society ("ATS"), an international educational and scientific organization, was founded in 1905. ATS, and the approximately 13,000 physicians and scientists it represents, help prevent and fight respiratory disease around the globe through research, education, patient care, and advocacy. ATS publishes a number of scientific journals that include studies on air pollution and health. In fact, the United States Environmental Protection Agency ("EPA") has consulted ATS guidelines to characterize the adverse effects of exposure to air pollution. *See, e.g., National Ambient Air Quality Standards for*

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[1] Pursuant to Supreme Court Rule 37.6, no counsel for any party authored this brief either in whole or in part. No persons other than the amici made any monetary contributions to its preparation or submission. Petitioners, Respondent, and the Solicitor General of the United States consented to this filing, and letters of consent are being submitted with the brief.

Ozone, 62 Fed. Reg. 38,856, 38,860 (July 18, 1997) (codified at 40 C.F.R. §§ 50.9, 50.10).

The American Association for Cardiovascular and Pulmonary Rehabilitation ("AACVPR"), founded in 1985, is a national organization representing approximately 3,000 members expert in assessing the harm to human health caused by air pollution. AACVPR and its physician and scientist members are dedicated to reducing morbidity, mortality, and disability from cardiovascular and pulmonary diseases. AACVPR carries out its goal through education, prevention, rehabilitation, research, and aggressive disease management programs, including publication of the *Journal of Cardiopulmonary Rehabilitation*, a scientific journal that includes studies on the health effects of air pollution.

The National Association for the Medical Direction of Respiratory Care ("NAMDRC") was founded in 1977 and represents approximately 600 members working at more than 2,000 hospitals nationwide. NAMDRC and its members are devoted to studying, preventing, and treating thoracic and respiratory diseases in order to carry out their mission of reducing the morbidity and mortality of patients with respiratory disorders. NAMDRC advances that mission through various prevention, education, and advocacy programs to protect lung health, such as filing comments with EPA regarding the public health impacts of proposed air pollutant regulations. *See, e.g.*, *National Ambient Air Quality Standards for Particulate Matter*, 71 Fed. Reg. 2,620 (proposed Jan. 17, 2006) (to be codified at 40 C.F.R. § 50).

The American College of Chest Physicians ("ACCP"), founded in 1935, is an international medical society

dedicated to providing postgraduate medical education for physicians, surgeons, and allied health professionals involved in the diagnosis and treatment of chest diseases. ACCP, and the more than 16,000 health care professionals it represents, help promote the prevention and treatment of diseases of the chest through leadership, education, research, and communication. ACCP publishes *CHEST*, a leading scientific journal featuring clinical research in pulmonary, critical care, sleep, and chest medicine disciplines. ACCP also advocates before government agencies and the courts, offering expert opinion on issues affecting cardiopulmonary health, including the effects of air pollution. *See, e.g., New York v. U.S. Environmental Protection Agency*, 413 F.3d 3, 30 (D.C. Cir. 2005) (discussing studies on the health effects of air emissions that were presented by amici, including ACCP).

Amici support Petitioners' position because of the significant negative health effects associated with increased emissions from coal-fired power plants.

SUMMARY OF ARGUMENT

Air pollution can have severe, even fatal, health effects. Coal-fired power plants, like those operated by Duke Energy Corporation ("Duke"), emit dangerous air pollutants, notably particulate matter, nitrogen oxides, and sulfur dioxide. Exposure to these pollutants can cause a myriad of health impacts, including premature death, increased hospitalization for asthma, and development of chronic respiratory diseases. Air pollution is especially harmful to children and their developing respiratory systems. Air pollution from power plants is also responsible for significant social welfare

costs, such as increased health care costs, job absences, and missed school days.

Congress added the Prevention of Significant Deterioration ("PSD") program to the Clean Air Act ("CAA") in 1977 specifically to protect public health and welfare from the injurious effects of air pollution by tightening existing pollution controls. Under the PSD program, the operator of an emitting facility in an area that has attained national ambient air quality standards ("NAAQS") may not undertake a "modification" of that facility unless EPA has issued a permit. To fulfill Congress's goal of protecting public health and welfare, EPA has required operators of coal-fired power plants to obtain a PSD permit for any plant modifications that will cause a significant increase in annual net emissions.

However, the Fourth Circuit Court of Appeals rejected EPA's interpretation of what constitutes a PSD "modification" and instead imposed a definition that will allow old coal-fired power plants to be completely refurbished and increase their total amount of harmful emissions, without being required to obtain a permit from EPA. Such plant refurbishments substantially increase the actual amount of air pollution emitted to the surrounding community, thereby further degrading air quality and causing significant adverse public health and welfare effects. Contrary to the Fourth Circuit's ruling, EPA correctly implemented a PSD program that achieves Congress's goal of protecting public health and welfare from the harms of increased air pollution from power plant "modifications."

ARGUMENT

I. Air Pollution from Coal-Fired Power Plants Has Significant and Severe Impacts on Public Health and Welfare.

Coal-fired power plants, which are comprised of individual electric generating units ("EGUs"), are major sources of three pollutants specifically addressed in the Clean Air Act: particulate matter ("PM"), nitrogen oxides ("NO_x"), and sulfur dioxide ("SO_2"). *See* 42 U.S.C. § 7403(g)(1) (2004). Not only are these pollutants harmful themselves, but NO_x and SO_2 also contribute to the formation of additional PM, and NO_x is an essential precursor to the creation of ozone. The emission of these pollutants, as well as their roles in forming additional pollutants after emission, has significant and severe impacts on public health, even when the pollutants are present at levels below the air quality standards mandated by the CAA. *See* Staff of Senate Committee on the Environment and Public Works, 95th Cong., *A Legislative History of the Clean Air Act Amendments of 1977*, 6634-55 (Comm. Print 1978) [hereinafter "*CAA 1977 Legis. History*"] (statement of the House Committee on Interstate and Foreign Commerce) (discussing multiple ways in which attainment of NAAQS does not adequately protect public health).

Children are especially vulnerable to the health impacts of air pollution because they breathe more air per pound of body weight than adults and because most of the human respiratory capacity is developed before the age of eighteen.[2] Moreover, because children are outside for

[2] Rodney R. Dietert et al., *Workshop to identify critical windows of exposure for children's health: immune and respiratory systems work-group summary*, 108 Envtl. Health Persp. 483 (2000); Blanka Binková

(Continued on following page)

longer periods of time and are usually more active when outdoors, they inhale more polluted air than adults typically do.[3]

A. Health Impacts of Particulate Matter

According to EPA, PM is a "mixture of microscopic solids and liquid droplets suspended in the air" made up of a number of different components, including acids, chemicals, metals, soils, dust, and allergens, such as pollen. U.S. Environmental Protection Agency, Office of Air and Radiation, EPA-452/F-03-001, *Particulate Pollution and Your Health* (2003), *available at* http://www.epa.gov/airnow/particle/pm-color.pdf. The particles that make up PM vary in size, but most are one-seventh to one-thirtieth the diameter of a strand of human hair. Researchers categorize PM according to size – generally speaking, coarse particles are between 2.5 and 10 microns in diameter ($PM_{10-2.5}$); fine particles are 2.5 microns in diameter or smaller ($PM_{2.5}$); and ultrafine particles are smaller than 0.1 micron in diameter.[4] Because of the relatively small size of individual particles, PM is often visible only as the haze that forms when millions of particles in the air blur the spread of sunlight.

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et al., *The effects of air pollution on children's health and development: a review of the evidence*, WHO Regional Office for Europe (2004), *available at* http://www.euro.who.int/document/EEHC/execsum.pdf.

[3] American Academy of Pediatrics, Committee on Environmental Health, *Ambient Air Pollution: Health Hazards to Children*, 114 Pediatrics 1699 (2004).

[4] U.S. Environmental Protection Agency, EPA/600/P-99/002aF, *Air Quality Criteria for Particulate Matter*, Vol. 1, p. 2-7 to 2-37 (2004), *available at* http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=435945.

Coal-fired power plants produce PM through both mechanical and chemical processes. Burning coal mechanically produces coarse PM and larger, visible particles by breaking or reducing large chunks of coal into smaller ash and soot, with the material itself remaining the same chemically.[5] Burning coal also emits elemental carbon, SO_2, and NO_x, which chemically react with water and other compounds in the atmosphere to form fine and ultrafine particles of different chemical compounds.[6]

Because of PM's size, these particles get trapped in the smaller airways and alveoli of the lungs, and the fine and ultrafine PM can pass through the alveoli into the blood stream, traveling throughout the body.[7] Although PM may vary in size and method of formation, the interaction of all sizes of PM with the body can have serious consequences.

Exposure to PM can kill.[8] When PM levels in the air are high, deaths can occur immediately (i.e., on that day or soon thereafter), or within one to two months, by inducing heart attacks and strokes.[9] In addition, daily exposure to

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[5] *Id.*

[6] *Id.*

[7] Gunter Oberdorster et al., *Nanotoxicology: An Emerging Discipline Evolving from Studies of Ultrafine Particles*, 113 Envtl. Health Persp. 823 (2005).

[8] C. Arden Pope III et al., *Particulate Air Pollution and Daily Mortality on Utah's Wasatch Front*, 107 Envtl. Health Persp. 567 (1999).

[9] Francesca Dominici et al., *On the Use of Generalized Additive Models in Time-Series Studies of Air Pollution and Health*, 156 Am. J. Epidemiology 193 (2002); Yun-Chul Hong et al., *Effects of Air Pollutants on Acute Stroke Mortality*, 110 Envtl. Health Persp. 187 (2002); Shang-Shyue Tsai et al., *Evidence for an Association Between Air Pollution*

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PM, even at low levels, can lead to death by causing life-threatening diseases.[10] Unfortunately, PM does not just make people die a few days earlier than they might otherwise; these are premature deaths that would not have occurred until months or years later if the air were cleaner.[11]

In addition to premature death, sharp increases in PM levels in air pollution have been linked to other serious health effects, including increased numbers of heart attacks (especially among the elderly and people with cardiovascular disease),[12] increased hospitalization for cardiovascular disease (including strokes and congestive heart failure),[13] increased emergency room visits for

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and Daily Stroke Admissions in Kaohsiung, Taiwan, 34 Stroke 2612 (2003).

[10] Douglas W. Dockery et al., *An Association Between Air Pollution and Mortality in Six U.S. Cities*, 329 New Engl. J. Med. 1753 (1993); C. Arden Pope III et al., *Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults*, 151 Am. J. Respir. & Crit. Care Med. 669 (1995); Daniel Krewski et al., *Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality* (Health Effects Institute 2000).

[11] Antonella Zanobetti et al., *The Temporal Pattern of Respiratory and Heart Disease Mortality in Response to Air Pollution*, 111 Envtl. Health Persp. 1188 (2003); Francesca Dominici et al., *Airborne Particulate Matter and Mortality: timescale effects in four US cities*, 157 Am. J. Epidemiology 1055 (2003).

[12] Daniela D'Ippoliti et al., *Air Pollution and Myocardial Infarction in Rome: a case-crossover analysis*, 14 Epidemiology 528 (2003); Antonella Zanobetti & Joel Schwartz, *The Effect of Particulate Air Pollution on Emergency Admissions for Myocardial Infarction: A Multicity Case-Crossover Analysis*, 113 Envtl. Health Persp. 978 (2005).

[13] Kristi B. Metzger et al., *Ambient Air Pollution and Cardiovascular Emergency Department Visits in Atlanta, Georgia, 1993-2000*, 15 Epidemiology 46 (2004); Shang-Shyue Tsai et al., *Evidence for an Association Between Air Pollution and Daily Stroke Admissions*, *supra*

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patients suffering from acute respiratory ailments,[14] and inflammation of lung tissue in otherwise healthy young adults.[15] In addition, scientific evidence shows that chronic exposure to PM can shorten life one to three years by increasing the risk of dying from lung cancer and cardiovascular diseases,[16] as well as by inflicting significant damage to the small airways of the lungs.[17]

Those at the greatest risk of adverse health effects from chronic exposure to PM pollution include children (18 years and younger), the elderly (65 years and older), people with chronic lung diseases (such as asthma, chronic bronchitis, and emphysema), people with chronic cardiovascular

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note 10; Gregory Wellenius et al., *Particulate Air Pollution and Hospital Admissions for Congestive Heart Failure in Seven United States Cities*, 97 Am. J. Cardiology 404 (2006); Gregory Wellenius et al., *Particulate Air Pollution and the Rate of Hospitalization for Congestive Heart Failure among Medicare Beneficiaries in Pittsburgh, Pennsylvania*, 161 Am. J. Epidemiology 1030 (2005).

[14] Stephen Van Den Eeden et al., Final Report to the California Air Resources Board, Contract 97-303, *Particulate Air Pollution and Morbidity in the California Central Valley: a high particulate pollution region* (2002).

[15] Andrew J. Ghio et al., *Concentrated Ambient Air Particles Induce Mild Pulmonary Inflammation in Healthy Human Volunteers*, 162 Am. J. Respir. & Crit. Care Med. 981 (2000).

[16] C. Arden Pope III, *Epidemiology of Fine Particulate Air Pollution and Human Health: biological mechanisms and who's at risk?*, 108 Envtl. Health Persp. 713 (2000); C. Arden Pope III et al., *Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution*, 287 J. Am. Med. Ass'n 9 (2002); C. Arden Pope III et al., *Cardiovascular Mortality and Year-round Exposure to Particulate Air Pollution: epidemiological evidence of general pathophysiological pathways of disease*, 109 Circulation 71 (2004).

[17] Andrew Churg et al., *Chronic Exposure to High Levels of Particulate Air Pollution and Small Airway Remodeling*, 111 Envtl. Health Persp. 714 (2003).

disease, and people with diabetes.[18] Children are among the most vulnerable to continual exposure to PM, beginning even before they are born and shaping the future of their bodies' ability to function. Chronic exposure to PM has been linked to increased risk of premature birth and slowed lung function growth in children and teenagers.[19] Short-term increases in PM levels are especially harmful to children, causing increased severity of asthma attacks and increased hospitalization for asthma.[20]

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[18] U.S. Environmental Protection Agency, *Air Quality Criteria for Particulate Matter*, *supra* note 4; Antonella Zanobetti & Joel Schwartz, *Are Diabetics More Susceptible to the Health Effects of Airborne Particles?*, 164 Am. J. Respir. & Crit. Care Med. 831 (2001).

[19] Sharon K. Sagiv et al., *A Time Series Analysis of Air Pollution and Preterm Birth in Pennsylvania, 1997-2001*, 113 Envtl. Health Persp. 602 (2005); W. James Gauderman et al., *Association between Air Pollution and Lung Function Growth in Southern California Children: results from a second cohort*, 166 Am. J. Respir. & Crit. Care Med. 76 (2002); W. James Gauderman et al., *The effect of air pollution on lung development from 10 to 18 years of age*, 351 New Engl. J. Med. 1057 (2004).

[20] James C. Slaughter et al., *Effects of Ambient Air Pollution on Symptom Severity and Medication Use in Children with Asthma*, 91 Ann. Allergy Asthma & Immunology 346 (2003); Mei Lin et al., *The Influence of Ambient Coarse Particulate Matter on Asthma Hospitalization in Children: case-crossover and time-series analyses*, 110 Envtl. Health Persp. 575 (2002); Gary Norris et al., *An Association Between Fine Particles and Asthma Emergency Department Visits for Children in Seattle*, 107 Envtl. Health Persp. 489 (1999); Paige E. Tolbert et al., *Air Quality and Pediatric Emergency Room Visits for Asthma in Atlanta, Georgia*, 151 Am. J. Epidemiology 798 (2000).

B. Health Impacts of Nitrogen Oxides

In addition to PM, coal-burning power plants produce nitrogen oxides, or NO_x, a term referring to variant combinations of nitrogen and oxygen atoms in the atmosphere.[21] High-temperature combustion processes, such as those occurring in coal-fired EGUs, motor vehicles, and heavy equipment, are the primary outdoor sources of NO_x emissions.[22] Power plant NO_x emissions' most significant impact occurs from their role as a precursor to PM and ozone, but NO_x emissions also directly harm human health.[23]

1. Ozone

Ozone is a dangerous pollutant that forms when NO_x in the air combines with volatile organic compounds in the presence of heat and sunlight.[24] Recent studies have shown that acute exposure to ground level ozone can kill. Two studies published in 2004, one looking at ninety-five cities

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[21] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA/456/F-98-005, *NO_x: how nitrogen oxides affect the way we live and breathe* (1998), *available at* http://www.epa.gov/oar/noxfldr.pdf.

[22] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA/454/R-3-005, *2003 Special Trends Report* (2003) at 17.

[23] U.S. Environmental Protection Agency, Office of Air and Radiation, EPA-452/R-97-002, *Nitrogen Oxides: Impacts on Public Health and the Environment* (1997); U.S. Environmental Protection Agency, *NO_x: how nitrogen oxides affect the way we live and breathe*, *supra* note 21.

[24] U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, factsheet, *Health and Environmental Effects of Ground-Level Ozone* (1997), *at* http://www.epa.gov/ttn/oarpg/naaqsfin/o3health.html (last viewed on July 13, 2006).

across the United States and the other examining twenty-three European cities, found that even on days when ozone levels were below the current national standards, an increase in ozone significantly increased the risk of premature death.[25] Three subsequent studies reviewed other data and confirmed that short-term exposure to high levels of ozone can shorten life.[26]

Premature deaths from exposure to ozone occur because "[o]zone is capable of causing inflammation in the lung at lower concentrations than any other gas, . . . [which] would be a hazard to anyone with heart failure and pulmonary congestion, and would worsen the function of anyone with advanced lung disease." David V. Bates, *Ambient Ozone and Mortality*, 16 Epidemiology 427, 428 (2005). In addition, research indicates that chronic ozone exposure may lead to decreased lung function in the general population.[27]

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[25] *See* Michelle L. Bell et al., *Ozone and short-term mortality in 95 US urban communities, 1987-2000*, 292 J. Am. Med. Ass'n 2372 (2004); Alexandros Gryparis et al., *Acute Effects of Ozone on Mortality from the "Air Pollution and Health: A European Approach" Project*, 170 Am. J. Respir. & Crit. Care Med. 1080 (2004).

[26] Michelle L. Bell et al., *A Meta-Analysis of Time-Series Studies of Ozone and Mortality with Comparison to the National Morbidity, Mortality, and Air Pollution Study*, 16 Epidemiology 436 (2005); Jonathan I. Levy et al., *Ozone Exposure and Mortality: An Empiric Bayes Metaregression Analysis*, 16 Epidemiology 458 (2005); Kazuhiko Ito et al., *Associations Between Ozone and Daily Mortality: Analysis and Meta-Analysis*, 16 Epidemiology 446 (2005); Steven N. Goodman, *The Methodologic Ozone Effect*, 16 Epidemiology 430 (2005).

[27] Committee of the Environmental & Occupational Health Assembly of the American Thoracic Society, *Health effects of outdoor air pollution*, 153 Am. J. Respir. & Crit. Care Med. 3, 26-27 (1996); Audrey Galizia & Patrick L. Kinney, *Long-term Residence in Areas of High Ozone*, 107 Envtl. Health Persp. 675 (1999).

Scientists have long recognized the harmful health effects of ozone exposure, including shortness of breath, chest pain when inhaling deeply, wheezing and coughing, increased susceptibility to respiratory infections, and increased risk of asthma attacks.[28] Children, senior citizens, people who work or exercise outdoors, people with lung diseases (such as asthma, chronic bronchitis, and emphysema), and otherwise healthy people who have an enhanced ozone reactions are especially vulnerable to the effects of breathing ozone.[29]

For people with asthma, ozone exposure is especially harmful, increasing the need for medical treatment and for hospitalization.[30] Health experts warn that air pollution,

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[28] ATS Comm., *Health Effects of Outdoor Air Pollution*, *supra* note 27.

[29] Helene Desqueyroux et al., *Effects of Air Pollution on Adults with Chronic Obstructive Pulmonary Disease*, 6 Archives Envtl. Health 554 (2002); Peter Höppe et al., *Environmental Ozone Effects in Different Population Subgroups*, 206 Int'l J. Hygiene & Envtl. Health 505 (2003); Ralph J. Delfino et al., *Emergency Room Visits for Respiratory Illnesses Among the Elderly in Montreal: Association with Low Level Ozone Exposure*, 76 Envtl. Res. 67 (1998); John M. Peters et al., *A Study of Twelve Southern California Communities with Differing Levels and Types of Air Pollution II: Effects on Pulmonary Function*, 159 Am. J. Respir. & Crit. Care Med. 768 (1999); George D. Thurston et al., *Summertime Haze Air Pollution and Children with Asthma*, 155 Am. J. Respir. & Crit. Care Med. 654 (1997); Patrick L. Kinney & Mortin Lippmann, *Respiratory Effects of Seasonal Exposures to Ozone and Particles*, 55 Archives Envtl. Health 210 (2000).

[30] Janneane F. Gent et al., *Association of Low-Level Ozone and Fine Particles with Respiratory Symptoms in Children with Asthma*, 290 J. Am. Med. Ass'n 1859 (2003); Helene Desqueyroux et al., *Short-Term Effects of Low-Level Air Pollution on Respiratory Health of Adults Suffering from Moderate to Severe Asthma*, 89 Envtl. Res. 29 (2002); Richard T. Burnett et al., *Association Between Ozone and Hospitalization for Respiratory Diseases in 16 Canadian Cities*, 72 Envtl. Res. 24 (1997).

including ozone, is "one of the most under-appreciated contributors to asthma exacerbation." George D. Thurston & David V. Bates, *Air Pollution as an Underappreciated Cause of Asthma Symptoms*, 290 J. Am. Med. Ass'n 1915, 1915 (2003). Even at levels currently considered safe, children with asthma are among those most vulnerable to ozone pollution.[31] A recent study suggests that year-round exposure to ozone may be associated with an increased risk of the development of asthma in children.[32] While more research is needed to confirm this finding, researchers tracked 3,500 students in Southern California and found an increased onset of asthma in children who took part in three or more outdoor activities in communities with high levels of ozone.[33]

2. Nitrogen Dioxide

In addition to forming ozone and PM, NO_x emissions from coal-fired power plants can also directly harm human health. Most NO_x enters the atmosphere as nitrogen oxide (NO) and then readily convert to nitrogen dioxide (NO_2), a reddish-brown gas that can become an important component of urban haze.[34]

EPA has determined that short-term exposure to NO_2 can lead to increases in respiratory diseases in children

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[31] Janneane F. Gent et al., *Association of Low-Level Ozone and Fine Particles with Respiratory Symptoms in Children with Asthma*, *supra* note 30.

[32] *See* Rob McConnell et al., *Asthma in Exercising Children Exposed to Ozone*, 359 Lancet 386 (2002).

[33] *Id.*

[34] U.S. Environmental Protection Agency, *2003 Special Trends Report*, *supra* note 22.

five to twelve years old, as well as coughing and increased changes in airway responsiveness and pulmonary function in adults with chronic lung diseases.[35] Long-term exposure to NO_2 may lead to increased susceptibility to respiratory infection and may cause emphysema-like lesions in the lungs.[36] Research has also shown that healthy adult women who are exposed to NO_2 experience an increase in the severity of their subsequent response to ozone.[37]

Exposure to NO_2 emissions is particularly harmful to children, weakening their defenses against respiratory infection and reducing lung function.[38] In fact, research suggests that children exposed to high levels of NO_2 may become more susceptible to critical infections of the respiratory tract.[39]

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[35] U.S. Environmental Protection Agency, Research Triangle Park, EPA-452/R-95-005, *Review of the National Ambient Air Quality Standards for Nitrogen Oxides: Assessment of Scientific and Technical Information* (1995); *National Ambient Air Quality Standards for Nitrogen Dioxide: Final Decision*, 61 Fed. Reg. 52,852 (October 8, 1996) (codified at 40 C.F.R. § 50).

[36] U.S. Environmental Protection Agency, *Review of the National Ambient Air Quality Standards for Nitrogen, Oxides, supra* note 35.

[37] Milan J. Hazucha et al., *Lung Function Response of Healthy Women after Sequential Exposures to NO_2 and O_3*, 150 Am. J. Respir. & Crit. Care Med. 642 (1994).

[38] W. James Gauderman et al., *Association Between Air Pollution and Lung Function Growth in Southern California Children, supra* note 18.

[39] Leonardo Trasande & George D. Thurston, *The Role of Air Pollution in Asthma and Other Pediatric Morbidities*, 115 J. Allergy & Clinical Immunology 689 (2005).

C. Health Impacts of Sulfur Dioxide

Sulfur dioxide (SO_2), a gaseous compound formed largely by burning coal and oil containing sulfur, is another pollutant emitted from coal-fired power plants that has significant adverse health effects.[40] For most healthy people, SO_2 appears to be a temporary irritant, generally causing comparatively minor discomfort. However, if an individual resides near a source of continuous SO_2 emissions, such as a coal-fired power plant, the irritant can become a persistent aggravation.[41] For people with asthma, short-term exposures to high levels of SO_2 has been linked to rapidly worsened asthma, increasing the need for hospitalization.[42]

Since SO_2 is often present with other pollutants in the air, especially PM and ozone, exposure to SO_2 provides a good example of how a combination of air pollutants may increase the overall adverse health effects of air pollution. In one study, researchers exposed teenagers with asthma to ozone alone, SO_2 alone, and then ozone followed by SO_2, and found that the last combination triggered bronchial reactions.[43] In addition, research suggests that increased

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[40] U.S. Environmental Protection Agency, *2003 Special Trends Report, supra* note 22, at 43.

[41] American Lung Association, *Health Effects of Outdoor Air Pollution* (1996) at 18.

[42] Donald Horstman and Lawrence J. Folinsbee, *Sulfur dioxide-Induced Bronchoconstriction in Asthmatics Exposed for Short Durations under Controlled Conditions: A Selected Review, in Susceptibility to Inhaled Pollutants* (M. Utell & R. Frank eds., 1989); Jordi Sunyer et al., *Urban air pollution and Emergency Admissions for Asthma in Four European Cities: the APHEA Project*, 52 Thorax 760 (1997).

[43] *See* Jane Q. Koenig et al., *Prior Exposure to Ozone Potentiates Subsequent Response to Sulfur Dioxide in Adolescent Asthmatic Subjects*, 141 Am. Rev. Respir. Disease 377 (1990).

levels of SO_2 pollution in the air, in conjunction with PM, may trigger a small but measurable loss of lung function in children.[44]

D. Social Welfare Impacts of Emissions from Coal-Fired Electric Generating Units

In addition to direct adverse health effects, air pollution caused by emissions from coal-fired power plants produces serious social welfare impacts. The costs associated with the myriad of health effects of air pollution are staggering. For example, air pollution from coal-fired power plants in the Midwest has been associated with $25 billion per year in health costs.[45] Air pollution also inflates social welfare costs through increased hospital admissions. Increases in coarse PM (PM_{10}) and nitrogen dioxide (NO_2) pollution are associated with increased hospital admissions for cardiovascular disease.[46] Patients diagnosed with arrhythmia or congestive heart failure are particularly likely to be admitted to the hospital during periods of high air pollution.[47] In addition to hospital admissions, increased air pollution can also result in increased costs

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[44] Douglas W. Dockery et al., *Change in Pulmonary Function in Children Associated with Air Pollution Episodes*, 32 J. Air Pollution Control Ass'n 937 (1986); Willem R. M. Dassen et al., *Decline in Children's Pulmonary Function During an Air Pollution Episode*, 36 J. Air Pollution Control Ass'n 1223 (1986).

[45] World Watch Institute, World Watch Paper #94, *Cleaning the Air: A Global Agenda* (1994) at 12.

[46] William S. Linn et al., *Air Pollution and Daily Hospital Admissions in Metropolitan Los Angeles*, 108 Envtl. Health Persp. 427 (2000).

[47] Jennifer K. Mann et al., *Air Pollution and Hospital Admissions for Ischemic Heart Disease in Persons with Congestive Heart Failure or Arrhythmia*, 110 Envtl. Health Persp. 1247 (2002).

associated with standard doctors' office visits, treatment of respiratory illnesses, and lost work days.[48]

Because of the particular vulnerability of children to air pollution, another serious social and economic impact resulting from air pollution is lost school days. A recent study found that increases in ozone led to an increase in illness-related, particularly respiratory-based, absences from school.[49] Such school absences are costly to students, educators, and parents. Students who miss school are likely to suffer academically and to frustrate educators' efforts to teach them. Parents of children who are too sick to go to school often face a dilemma between missing work in order to care for their children, leaving their sick children home alone, or locating childcare, a resource that is extremely scarce and costly.

E. Public Health and Social Welfare Impacts of Air Pollution in the Carolinas

Of particular importance in this case, air pollution from coal-fired power plants harms the health and social welfare of people living in North Carolina and South Carolina (collectively, "the Carolinas"). EPA data for the

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[48] *See, e.g.*, Miriam G. Cisternas et al., *A comprehensive study of direct and indirect costs of adult asthma*, 111 J. Allergy & Clinical Immunology 1212 (2003) (estimating that adult asthma patients spend an average of $5,000 annually on asthma related expenses); California Environmental Protection Agency, Air Resources Board, *Recent Research Findings* (2004) at 4, *available at* http://www.arb.ca.gov/research/health/fs/pm-03fs.pdf (estimating that air pollution in California results in about 2.8 million lost work days per year).

[49] *See* Frank D. Gilliland et al., *The Effects of Ambient Air Pollution on School Absenteeism Due to Respiratory Illness*, 12 Epidemiology 43 (2001).

2005 operating year show that coal-fired power plants in North Carolina emitted 500,935 tons of SO_2 and 114,299 tons of NO_x.[50] In South Carolina, coal-fired power plants emitted 217,385 tons of SO_2 and 53,403 tons of NO_x in 2005.[51]

Contributing to the air pollution in the Carolinas are the eight coal-fired power plants operated by Duke that are at issue in this case (seven are located in North Carolina, and one is located in South Carolina). Data collected by EPA show that the Duke plants emitted 310,000 tons of SO_2 and 59,187 tons of NO_x in 2005 – more than one-third of the total emissions of these pollutants in the Carolinas.[52] Emissions of $SO_2$and NO_x from coal-fired power plants in

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[50] U.S. Environmental Protection Agency, *Clean Air Markets – Data & Maps: Where You Live, at* http://cfpub.epa.gov/gdm/index.cfm?fuseaction=whereyoulive.nation (follow "North Carolina" link) (last viewed on July 13, 2006).

[51] *Id.* (follow "South Carolina" link) (last viewed on July 13, 2006).

[52] U.S. Environmental Protection Agency, *Clean Air Markets – Data & Maps: Facility Emissions Report, at* http://cfpub.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard (follow "Monitoring Location Level Emissions" link) (last viewed on July 13, 2006). The EPA website generated the following report for the eight Duke facilities at issue:

State	Facility Name	Facility ID	Year	SO_x Tons	NO_x Tons
NC	Belews Creek	8042	2005	96,812.7	20,419.3
NC	Buck	2720	2005	9,581.8	2,260.2
NC	Cliffside	2721	2005	28,209.1	3,986.7
NC	Dan River	2723	2005	4,248.3	1,611.2
NC	G G Allen	2718	2005	45,424.3	8,324.5
NC	Marshall	2727	2005	100,540.4	17,534.5
NC	Riverbend	2731	2005	13,964.0	2,619.7
SC	W S Lee	3264	2005	11,219.7	2,431.1
			TOTAL	**310,000.3**	**59,187.2**

the Carolinas not only harm human health directly, but they also contribute to the further formation of dangerous PM and ozone.

Using EPA emissions data and relevant scientific research, researchers from Abt Associates were able to assess the direct health impacts of air pollution from power plants in individual states.[53] *See* Abt Associates, Inc., *The Particulate-Related Health Benefits of Reducing Power Plant Emissions* (October 2000) [hereinafter "Abt Study"], *available at* http://www.abtassociates.com/reports/particulate-related.pdf. That study found that air pollution from coal-fired power plants had a negative impact on public health and social welfare throughout the nation. *See generally id.* at 1-1 to 1-2, and 6-10. With regard to the Carolinas, the Abt Study estimated that air pollution from coal-fired power plants in South Carolina annually contributes to approximately 800 deaths, 500 hospitalizations, 500 new cases of chronic bronchitis, and 16,600 asthma attacks, about 200 of which lead to emergency room ("ER") visits. *Id.* at 6-10. In North Carolina, the estimated yearly health effects of air pollution from coal-fired power plants are even more astounding, contributing to roughly 1,800 deaths, 1,200 hospital admissions, 1,100 cases of chronic bronchitis, and 37,000 asthmas attacks, nearly 450 of which lead to ER visits. *Id.*

In addition to direct health effects, people living in the Carolinas experience serious social and economic impacts from air pollution. For example, the Abt Study estimated

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[53] Abt Associates is a scientific research and policy analysis consulting firm that EPA has employed to conduct research regarding air pollution. Abt Study at i.

that, each year, air pollution from power plants results in about 322,000 lost work days in North Carolina and 141,000 lost work days in South Carolina. *Id.* Air pollution can also lead to days in which people do not feel able to participate fully in their normal activities and must restrict their behavior. *See* Abt Study at 5-25 (discussing "minor restricted activity days" or MRADs). The Abt Study estimated that each year, air pollution from power plants leads to 721,000 restricted activity days in South Carolina and 1,640,000 restricted activity days in North Carolina. *Id.* at 6-10.

Any increase in air pollution from the Duke power plants can only make these statistics worse in the Carolinas, especially for the people living, working, learning, and playing in communities near the plants. Moreover, air pollution from these plants will also harm the public health and welfare of communities that are downwind from the emissions.[54]

II. The Fourth Circuit's Interpretation of a PSD "Modification" Is Inconsistent with Congressional Intent and Would Adversely Affect Public Health and Welfare.

Finding that air pollution had resulted in "mounting dangers to the public health and welfare," Congress enacted the CAA "to protect and enhance the quality of the

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[54] *See* Abt Study at E-2 (discussing calculation of impacts due to downwind air pollution); U.S. Environmental Protection Agency, *Air Trends: International Issues & U.S. Air Quality*, *at* http://www.epa.gov/airtrends/international.html (last viewed July 19, 2006) (noting that downwind flow of air pollution in the U.S., Canada, and Mexico is "well known and documented").

Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." 42 U.S.C. §§ 7401(a)(2), (b)(1) (2004). However, these congressional goals are undermined by the Fourth Circuit's holding that EPA must use the same regulatory test to determine whether facility "modifications" are subject to the PSD, 42 U.S.C. § 7470 (2004), and New Source Performance Standards ("NSPS"), 42 U.S.C. § 7411 (2004), programs.

In passing the Clear Air Act Amendments of 1977, Congress understood that the "maximum feasible protection of the public health" occurs only when sources of pollution were subjected to both the NSPS and PSD programs.[55] *CAA 1977 Legis. History* at 6634 (finding of the House Committee on Interstate and Foreign Commerce). It is illogical to interpret the term "modification" the same in both the PSD and NSPS programs, given Congress's understanding in 1977 that a new program – one specifically designed to protect public health and welfare in areas that had attained the NAAQS – was needed to supplement the NSPS program.

Because the NSPS program does not consider the site-specific air quality impacts of a source's emissions, 42 U.S.C. § 7411(b) (2004), prior to the PSD program, new

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[55] New source review ("NSR") was incorporated into the CAA in 1977 to prevent new or modified sources of pollution from increasing their emissions in a way that would further deteriorate air quality in a community. PSD (Part C) is one component of the NSR program and applies to new or modified sources in areas that are in attainment with the NAAQS. The other component of NSR is nonattainment NSR (Part D), which provides emission requirements for new or modified sources in areas that have not attained the NAAQS. *See New York v. U.S. Environmental Protection Agency*, 413 F.3d 3 at 12-13 (describing NSR program).

and modified coal-fired power plants located in relatively unpolluted areas could comply with NSPS and still emit enough pollution to degrade local air quality, *CAA 1977 Legis. History* at 723-28 (statements of Sen. Muskie, chief Senate sponsor of the 1977 amendments). *See also Wisconsin Elec. Power Co. v. Reilly*, 893 F.2d 901, 904 (7th Cir. 1990) (noting that the NSPS program had "varying degrees of success in controlling pollution in different parts of the country"). Accordingly, Congress enacted the PSD program "to protect the public's health" by ensuring that emissions from new and modified facilities located in "so-called clean air areas" would not cause regional air quality to decline to the minimum level permitted under the NAAQS. *CAA 1977 Legis. History* at 6634 (statement of the House Committee on Interstate and Foreign Commerce).

Instead of requiring a PSD permit for any physical or operational change in an emitting facility that would result in a significant net increase in the *annual* emissions of regulated pollutants, 40 C.F.R. § 51.166(b) (2005) (regulatory definition of PSD "modification"), the Fourth Circuit's ruling would require a PSD permit only when a physical or operational change results in an increase in the facility's *hourly rate* of pollution emissions, 40 C.F.R. § 60.14(a) (2005) (regulatory definition of NSPS "modification"). Under such a rule, old coal-fired power plants could undergo refurbishment projects that markedly increase their overall annual emissions and further degrade air quality without receiving a permit from EPA, so long as the plants' hourly rate of emissions remain the same. The resulting public health harms and social welfare costs, *see generally* discussion § I, *supra*, are antithetical to the

CAA's central goal of protecting public health and welfare by improving air quality.

The modifications of the Duke coal-fired power plants at issue in this case are just the type of projects that Congress intended to be subject to the PSD program. While the refurbished Duke facilities have not increased their hourly rate of emissions under the NSPS program, they are located in NAAQS attainment areas and, under the challenged regulation, would have been required to install additional PSD pollution controls to decrease the total amount of pollution the upgraded EGUs will emit to the surrounding area.[56] Such controls would improve, or at least maintain, the overall air quality in the areas surrounding and downwind of the plants, as well as prevent exacerbation of the severe health effects of air pollution already experienced by people in the Carolinas and beyond. *See* discussion § I(E), *supra*; *see also CAA 1977 Legis. History* at 4950 (Statement of Sen. Buckley) (noting that the PSD program "lessens the danger that an upwind State will impose its pollution on a neighbor") and 4525 (statement of Sen. Muskie) (discussing concern of the National Academy of Sciences "that emissions 300-miles upwind could still contribute to problems in major cities").

Allowing old coal-fired power plants to undertake major renovations without being required to install the

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[56] Refurbished coal-fired plants will increase the amount of pollution emitted to the atmosphere by extending their operating life, thus forestalling the construction of new coal-fired plants that would be subject to more stringent CAA emission requirements. Additionally, since it also may make more economic sense to use refurbished plants as base load sources of electric power rather than for peaking purposes, there will be emissions of harmful air pollutants for more hours per day and/or during off-peak hours, when before there had been none.

more stringent pollution controls mandated by the PSD program undermines Congress's goal of protecting public health and welfare from increased air pollution. Long-term increases in air pollution will occur when a deteriorated Duke EGU is refurbished to extend its operational life for another 20 years, thereby raising the levels of PM and ozone in the air and increasing the risk of premature death in adults and asthma hospitalizations for children exposed to emissions from the plant. *See* discussion § I(A) and (B)(1), *supra*. Even short-term increases in pollution emissions, such as might occur when a Duke coal-fired power plant operates a few hours longer each day than it did prior to renovations, lead to increases in respiratory diseases in children exposed to NO_x, as well as rapidly worsened asthma for people exposed to SO_2. *See* discussion § I(B)(2) and (C), *supra*.

In addition, overall degradation of air quality due to the increased emissions from the refurbished Duke power plants could cause more missed school days for asthmatic children and more lost work days for adults, particularly in the Carolinas. *See* discussion § I(D) and (E), *supra*. Thus, the Fourth Circuit's ruling would inhibit, instead of promote, the "productive capacity" of the surrounding community. 42 U.S.C. § 7401(b)(1) (2004).

Allowing coal-fired power plants to undergo changes that increase their net annual emission of pollution without undergoing PSD review contravenes the legislative purpose of the PSD program – to *prevent* deterioration of air quality in order to protect public health and welfare better. *See Alabama Power Co. v. Costle*, 636 F.2d 323, 401 (D.C. Cir. 1979) (finding that the intent of the PSD provisions "is succinctly stated by the title of that part: 'Prevention of Significant Deterioration of Air Quality'") (citing 42

U.S.C. § 7470). The occurrence and severity of adverse health effects caused by air pollution, and the economic and social welfare costs that accompany them, are directly related to the total amount of harmful pollutants inhaled. *See generally* discussion § I, *supra*. Accordingly, the goals of the CAA are best implemented though programs that reduce the overall emission of harmful pollutants. Contrary to the Fourth Circuit's holding, Congress has clearly enacted, and EPA has correctly implemented, a PSD program that serves to protect the public health and welfare from the harms of increased air pollution.

CONCLUSION

For the foregoing reasons, the Court should reverse the Fourth Circuit Court of Appeals' decision.

Respectfully submitted,

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